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Attention

Attention is the process of concentrating on specific features of the environment, or on certain thoughts or activities. This focusing on specific features of the environment usually leads to the exclusion of other features of the environment (Colman, 2001; Reber, 1995).

OR

Attention can be defined as a concentration of mental activity that allows you to take in a limited portion of the vast stream of information available from both your sensory world and your memory (Shomstein, 2010; Styles, 2006; Weierich & Barrett, 2010). Meanwhile, the unattended items lose out, and they are not processed in detail. Notice, then, that attention is a vitally important ‘‘gatekeeper.’’ If you do not pay attention to a particular item, then this item basically does not exist in your cognitive system!

Attention History

Attention is the taking possession of the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thoughts. … It implies withdrawal from some things in order to deal effectively with others.

—William James, Principles of Psychology

William James (1890) distinguished between *“active”* and *“passive”* modes of attention. Attention is active when controlled in a top-down way by the individual’s goals or expectations but passive when controlled in a bottom-up way by external stimuli (e.g., a loud noise).

Attention tasks use both **bottom-up** and **top-down** processing. Specifically, we sometimes concentrate on our mental activity because an interesting stimulus in the environment has captured our attention (bottom-up processing). For example, an object in your peripheral vision might suddenly move, and you turn your head to see it more clearly. Other times, we concentrate on our mental activity because we want to pay attention to some specific stimulus (top-down processing). For example, you might be searching for a particular friend in a crowded cafeteria.

William James (1890), an early pioneer of **cognitive psychology.** James speculated about the number of ideas that a person could attend at one time. In contrast, the **behaviorists** did not study attention and the **Gestalt** Psychologists believed the concept of attention was unnecessary. However, cognitive psychologists revived interest in this topic. In fact, they have always considered attention to be important, from the beginning of the cognitive revolution and increasing during recent years (Chun et al., 2011; Gazzaniga et al., 2009; Wright & Ward, 2008).

Attention is central to many aspects of cognition. Attention has an effect on **perception** (paying attention to something increases the chances you will perceive it), on **memory** (you are more likely to remember something later if you were paying attention to it when it first occurred), on **language** (reading a sentence involves paying momentary attention to the words in the sentence, one after the other), and on **solving problems** (your success in solving the problem may depend on what aspect of the problem captures your attention).

The Attention and Consciousness

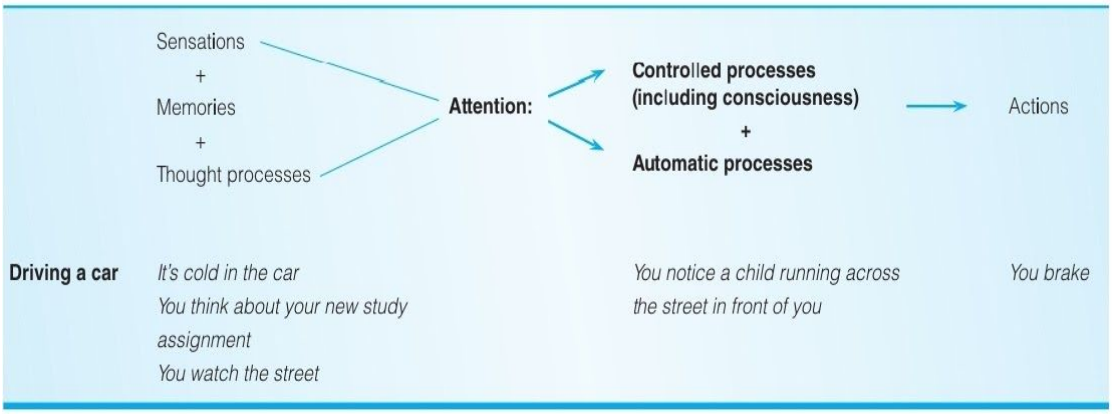
Attention is the means by which we actively process a limited amount of information from the enormous amount of information available through our senses, our stored memories, and our other cognitive processes (De Weerd, 2003a; Rao, 2003). It includes both **conscious and unconscious processes**.

In many cases, conscious processes are relatively easy to study. Unconscious processes are harder to study, simply because you are not conscious of them (Jacoby, Lindsay, & Toth, 1992; Merikle, 2000). For example, you always have a wealth of information available to you that you are not even aware of until you retrieve that information from your memory or shift your attention toward it. it is hard to study processes that are hidden somewhere in your unconsciousness, and of which you are not aware.

Attention allows us to use our limited mental resources judiciously. By dimming the lights on many stimuli from *outside* (sensations) and *inside* (thoughts and memories), we can highlight the stimuli that interest us. This heightened focus increases the likelihood that we can respond speedily and accurately to interesting stimuli. Heightened attention also paves the way for memory processes. We are more likely to remember information to which we paid attention than information we ignored.

At one time, psychologists believed that attention was the same thing as consciousness. Now, however, they acknowledge that some active attentional processing of sensory and of remembered information proceeds without our conscious awareness (Bahrami et al., 2008; Shear, 1997). For example, writing your name requires little conscious awareness. You may write it while consciously engaged in other activities. In contrast, writing a name that you have never encountered requires attention to the sequence of letters.

Consciousness includes both the feeling of awareness and the content of awareness, some of which may be under the focus of attention (Bourguignon, 2000; Farthing, 1992, 2000; Taylor, 2002). Therefore, attention and consciousness form two partially overlapping sets (Srinivasan, 2008; DiGirolamo & Griffin, 2003).



Conscious attention serves three purposes in playing a causal role for cognition.
First, it helps in monitoring our interactions with the environment. Through such monitoring, we maintain our awareness of how well we are adapting to the situation in which we find ourselves.
Second, it assists us in linking our past (memories) and our present (sensations) to give us a sense of continuity of experience. Such continuity may even serve as the basis for personal identity.
Third, it helps us in controlling and planning for our future actions. We can do so based on the information from monitoring and from the links between past memories and present sensations.

We will first explore different kinds of attention like **vigilance, search, selective attention, and divided attention**. Afterward, we will consider what happens when our attention does not work properly, and what strategies we use in order not to get overwhelmed in a world that is full of sensory stimuli. Then, we will explore the nature of automatic processes, which help humans to make the best use of their attentional resources.

Function of Attention

we will explore the four main functions of attention as well as theories to explain them :
Here are the four main functions of attention:
1. Signal detection and vigilance: We try to detect the appearance of a particular stimulus. Air traffic controllers, for example, keep an eye on all traffic near and over the airport.
2. Search: We try to find a signal amidst distracters, for example, when we are looking for our lost cell phone on an autumn leaf-filled hiking path.
3. Selective attention: We choose to attend to some stimuli and ignore others, as when we are involved in a conversation at a party.
4. Divided attention: We prudently allocate our available attentional resources to coordinate our performance of more than one task at a time, as when we are cooking and engaged in a phone conversation at the same time.

We will also have a look at a number of neuroscientific studies and explanatory models. Lastly, we will turn our attention to situations and conditions when our attention fails us.

Four Main Functions of Attention

Function	Description	Example
Signal detection and vigilance	On many occasions, we vigilantly try to detect whether we did or did not sense a signal—a particular target stimulus of interest. Through vigilant attention to detecting signals, we are primed to take speedy action when we do detect signal stimuli.	In a research submarine, we may watch for unusual sonar blips; on a dark street, we may try to detect unwelcome sights or sounds; or following an earthquake, we may be wary of the smell of leaking gas or of smoke.
Search	We often engage in an active search for particular stimuli.	If we detect smoke (as a result of our vigilance), we may engage in an active search for the source of the smoke. In addition, some of us are often in search of missing keys, sunglasses, and other objects.
Selective attention	We constantly are making choices regarding the stimuli to which we will pay attention and the stimuli that we will ignore. By ignoring or at least deemphasizing some stimuli, we thereby highlight particularly salient stimuli. The concentrated focus of attention on particular informational stimuli enhances our ability to manipulate those stimuli for other cognitive processes, such as verbal comprehension or problem solving.	We may pay attention to reading a textbook or to listening to a lecture while ignoring such stimuli as a nearby radio or television or latecomers to the lecture.
Divided attention	We often manage to engage in more than one task at a time, and we shift our attentional resources to allocate them prudently, as needed.	Experienced drivers easily can talk while driving under most circumstances, but if another vehicle seems to be swerving toward their car, they quickly switch all their attention away from talking and toward driving.

Signal Detection, Vigilance, and Search in Everyday Life
(a) Signal detection. Luggage screeners learn techniques to enable them to maximize "hits" and "correct rejections" and to minimize "false alarms" and "misses."
(b) Vigilance. For air traffic controllers, vigilance is a matter of life and death.
(c) Search. These trained police dogs are actively seeking out a target, such as bombs or drugs.

SEVERAL KINDS OF ATTENTION PROCESSES

We will perform several kinds of attention tasks. Let's first consider some examples and then define each kind of attention more precisely.

1. You may try to use **divided attention**, for example, concentrating on both your professor's lecture and a nearby whispered conversation between two students. You'll discover, though, that you cannot accurately attend to both categories of stimuli simultaneously. In reality, you are likely to use some form of **selective attention**, by trying to focus your attention. The remaining four items in this list require this selective attention.

2. You may try to avoid this divided-attention situation by focusing your attention on just one category of stimuli. Let's be optimistic and presume that you selectively attend to your professor, screening out almost all of the unattended conversation in this **dichotic listening** task.

3. You will try a demonstration about a kind of selective-attention task called the **Stroop task**. Most people don't encounter the Stroop task in their daily lives; however, you'll see how this task can be applied in clinical psychology.

4. You will definitely perform several **visual searches** by ignoring irrelevant items as you look for your yellow marker, your sweater, or the book that was on your desk a minute ago.
5. Finally, you will perform the fourth kind of selective attention the task called **saccadic eye movements**; your eyes will move systematically to the right to take in an appropriate amount of new information.

Signal Detection: Finding Important Stimuli in a Crowd

Signal-detection theory (SDT) is a framework to explain how people pick out the few important stimuli when they are embedded in a wealth of irrelevant, distracting stimuli. SDT often is used to measure sensitivity to a target's presence. When we try to detect a target stimulus (signal), there are four possible outcomes.

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Selective Attention

We explored the first two functions of attention—signal detection and search. Now, let's examine another function of attention—selective attention.

What Is Selective Attention?

The term selective attention refers to the fact that we usually focus our attention on one or a few tasks or events rather than on many. To say we mentally focus our resources implies that we shut out (or at least process less information from) other, competing tasks. As attention researcher Hal Pashler (1998) puts it, "At any given moment, [people's] awareness encompasses only a tiny proportion of the stimuli impinging on their sensory systems" (p. 2).

Colin Cherry cocktail party

Colin Cherry (1953, see also Bee & Micheyl, 2008) referred to this phenomenon as the cocktail party problem, the process of tracking one conversation in the face of the distraction of other conversations. He observed that cocktail parties are often settings in which selective attention is salient. Cherry did not actually hang out at numerous cocktail parties to study conversations. He studied selective attention in a more carefully controlled experimental setting. He devised a task known as **shadowing.** In shadowing, you listen to two different messages. Cherry presented a separate message to each ear, known as a **dichotic** presentation. You are required to repeat back only one of the messages as soon as possible after you hear it. In other words, you are to follow one message (think of a detective "shadowing" a suspect) but ignore the other.

Cherry's participants were quite successful in shadowing distinct messages in dichotic-listening tasks, although such shadowing required a significant amount of concentration. The participants were also able to notice physical, sensory changes in the unattended message—for example, when the message was changed to a tone or the voice changed from a male to a female speaker.

However, they did not notice semantic changes in the unattended message. They failed to notice even when the unattended message shifted from English to German or was played backward. Conversely, about one-third of people, when their name is presented during these situations, will switch their attention to their name. Some researchers have noted that those who

hear their names in the unattended message tend to have limited working-memory capacity. As a result, they are easily distracted (Conway, Cowan, & Bunting, 2001). Infants will also shift their attention to one of two messages if their name is said (Newman, 2005).

Think of being in a noisy restaurant. Three factors help you to selectively attend only to the message of the target speaker to whom you wish to listen:

1. Distinctive sensory characteristics of the target's speech. Examples of such characteristics are high versus low pitch, pacing, and rhythmicity.
2. Sound intensity (loudness).
3. Location of the sound source (Brungard & Simpson, 2007).

Attending to the physical properties of the target speaker's voice has its advantages. You can avoid being distracted by the semantic content of messages from nontarget speakers in the area. Clearly, the sound intensity of the target also helps. In addition, you probably turn one ear toward and the other ear away from the target speaker. Note that this method offers no greater total sound intensity. The reason is that with one ear closer to the speaker, the other is farther away. The key advantage is the difference in volume. It allows you to locate the source of the target sound. Recent psychophysical studies have found, however, that spatial cues are less important than factors like how harmonious and rhythmic the target sounds (Darwin, 2008; Muente et al., 2010).

Theories of Selective Attention

We will discuss several theories of selective attention. Note how dialectical processes influenced the development of subsequent theories. The theories described here belong to the group of filter and bottleneck theories. A filter blocks some of the information going through and thereby selects only a part of the total of information to pass through to the next stage. A bottleneck slows down information passing through. The models differ in two ways. First, do they have a distinct "filter" for incoming information? Second, if they do, wherein the processing of information does the filter occur (early or late)?

Broadbent's Model

According to one of the earliest theories of attention, we filter information right after we notice it at the sensory level (Broadbent, 1958;). Multiple channels of sensory input reach an attentional filter. Those channels can be distinguished**READ MORE**

{Theories of Focused Visual Attention in short

Spotlight theory

Resembles the idea that we have a small field of vision and it is hard to see things outside of this spotlight region, although attention can be shifted by moving this light.

Zoom theories

Eriksen & St James (1986) instead proposed that attention is more like a zoom lens which can be adjusted to cover a large area in much detail or a small area in specific detail, so the size of the visual field that is attended to can vary.

Treisman's – feature integration theory (1988/1992)

There is a distinction between objects and their features (for example, colour) where all basic features are processed rapidly, in parallel and in an automatic, pre-attentive way. Features are combined in a serial process – to form objects – which is influenced by knowledge, but in the absence of knowledge, illusions may be created.

Wolfe's – guided search theory (1998)

This is similar to the above as there is an initial feature base, then subsequent general search process. It is not, however, assumed that processing is parallel then serial. Instead, initial feature processing produces an activation map, with each input showing individual levels; attention is then allocated on the basis of highest–lowest activation.

Duncan & Humphrey's – attentional engagement theory (1989, 1992)

All items are analyzed in terms of their features and then a later stage of processing occurs where input is matched for its likeness in STM. Here, speed is determined by the amount of desegregation required and the similarity present in non-target items; thus items that are similar will be selected together }

The Multimode Model of Attention

So where does selection take place? A more current view is that selection can occur early or late. Michael Posner and Charles Snyder (1975) advocate the idea of a "moveable filter," one that can operate at various points in processing according to the observer's needs. Data from another study support what seemed to some to be the case all along, that selection can be based on physical or semantic properties (Johnston & Heinz, 1978).

They found, however, that semantic selection imposes a greater cost, that is, it requires greater attentional resources than physical selection. The model that arises from the view that selection can be based on multiple modes, for example, the physical and the semantic, is called **the multimode model of attention.**

There is also neurophysiological evidence to support the multimode model. Hillyard, Hink, Schwent & Picton (1973) used an event-related potential (ERP) technique to investigate when selection occurs. The ERP records brain electrical activity that happens in response to the presentation of a stimulus. According to their design, the researchers had participants attend to a stimulus, say, coming from the left ear, and compared the activity observed under that condition with observable activity related to an identical unattended target, say, coming from the right ear.

They observed a very rapid change in electrical activity only 80 milliseconds after the stimulus was presented, which suggested that selection was happening early on in response to perceptual characteristics. However, other ERP studies showed a change in electrical activity that happened approximately 300 milliseconds after stimulus onset, which suggested a late selection based on task relevance and, perhaps, semantic features (Luck & Hillyard, 1994). To summarize, it appears that attentional selection is more flexible than was first assumed. It can happen early or late and can be based on more than just a single mode.

Kahneman's Capacity Model of Attention

Capacity models describe attention as a resource. We can think of this resource as the amount of mental effort or energy required to perform a task. Like many other resources,

attention exists in limited supply. At any given time, we only have so much of it that is available for use.

Daniel Kahneman, in his 1973 book Attention and Effort,**READ MORE**

Divided Attention Tasks

In a classic study that examined this type of divided attention task, two participants were trained to take dictation for spoken words while reading unrelated material for comprehension (Spelke, Hirst, & Neisser, 1976). In divided attention tasks such as these, each task is evaluated separately, in order to determine baseline performance when the individual can allocate as many cognitive resources as necessary to one task at a time.

Then performance is evaluated when the two tasks are performed simultaneously. A decrease in performance for either task would suggest that even if attention can be divided or switched between the tasks, the cognitive demands are too great to avoid disruption of performance. (We should note here that divided attention tasks are designed, in principle, to see if two tasks can be carried out simultaneously.

A related research area looks at task switching and how well we can switch back and forth among different tasks [e.g., Monsell, 2003]. It turns out that switching itself is cognitively demanding and can impair performance.)

The focus of the Spelke et al. (1976) study was whether individuals could learn to perform two relatively complex tasks concurrently, without impairing performance. The participants received plenty of practice—the study lasted 17 weeks and they had a 1-hour session each day, 5 days a week. These participants were able to learn to take dictation for lists of words and read for comprehension without affecting performance in either task, and the authors suggested that perhaps there are not fixed limits on our attentional capacity.

However, changing the tasks somewhat, such as reading aloud rather than silently, impaired performance initially, so this multitasking ability may be specific to these well-learned tasks. Indeed, not everyone could learn to perform two complex tasks without performance costs (Hirst, Neisser, & Spelke, 1978), although the fact that some can is impressive.

An entirely different approach to studying divided attention has focused on extremely simple tasks that require speedy responses. When people try to perform two overlapping speeded tasks, the responses for one or both tasks are almost always slower (Pashler, 1994). When a second task begins soon after the first task has started, the speed of performance usually suffers. However, they cannot readily accomplish more than one cognitive task requiring them to choose a response, retrieve information from memory, or engage in various other cognitive operations.

How well people can divide their attention also has to do with their intelligence (Hunt & Lansman, 1982). For example, suppose that participants are asked to solve mathematical problems and simultaneously to listen for a tone and press a button as soon as they hear it. We can expect that they both would solve the math problems effectively and respond quickly to hearing the tone. According to Hunt and Lansman, more intelligent people are better able to a timeshare between two tasks and to perform both effectively.

Distracted Driving

More relevant to our current lifestyles are questions about multitasking while texting or having cell phone conversations. Research designed to investigate, under controlled conditions, multitasking while driving has revealed some surprising results.

Certainly, there are many possible types of distractions that could impair driving performance, such as applying makeup using the rearview mirror, attempting (usually in vain) to stop the kids in the backseat from fighting, fiddling with the CD player, trying to negotiate a handheld cell phone, a cigarette, and a soda all at once, eating a bowl of cereal while driving (!). But we tend to have a strong sense that we CAN multitask while driving, and cars are being built with more and more technological capabilities that encourage multitasking. How good are we at dividing attention in these cases?

Most people acknowledge the distraction caused by texting while driving and the reason seems obvious: Your eyes are off the road and your hands and at least one hand (often both) are engaged while texting. However, the problem is not simply one of occupied hands or eyes, but rather that the cognitive demands on our limited capacity systems can seriously impair driving performance (Strayer, Watson, & Drews, 2011).

The effect of a cell phone conversation on performance (such as not noticing someone's brake lights or responding more slowly to them) is just as significant when the individual is having a conversation with a hands-free device as with a handheld phone; the same impairments do not occur when listening to the radio or a book on tape (Strayer & Johnston, 2001).

Moreover, studies using eye-tracking devices have shown that drivers are less likely to later recognize objects that they did look at when using a cell phone while driving (Strayer & Drews, 2007). These findings demonstrate that cognitive distractions such as cell phone conversations can produce inattentional blindness, or a lack of awareness of what is right before your eyes (see also, Simons & Chabris, 1999).

Sadly, although we all like to think that we can multitask while driving, in fact, the percentage of people who can truly perform cognitive tasks without impairing their driving performance is estimated to be about 2% (Watson & Strayer, 2010).

Factors Determining Dual-Task Performance

Task Similarity

When we think of pairs of activities that are performed well together in everyday life, the examples that come to mind usually involve two rather dissimilar activities (e.g. driving and talking; reading and listening to music).

There is much evidence that the degree of similarity between two tasks is of great importance. when people attempt to shadow or repeat back prose passages while learning auditorily presented words, their subsequent recognition-memory performance for the words is at chance level (Allport et al., 1972).

READ MORE) discovered that the Stroop effect was much larger when the distracting information (i.e. the colour name) was in the same location as the to-be-named colour rather than in an adjacent location.

This means that the processes producing the Stroop effect are not entirely unavoidable and thus are not completely automatic in the strict sense of the term. Relatively few processes are fully automatic in the sense of conforming to the criteria described earlier, with a much larger number of processes being only partially automatic.

Shiffrin and Schneider's Theory

Shiffrin and Schneider (1977) and Schneider and Shiffrin (1977) argued for a theoretical distinction between controlled and automatic processes. According to them:

. Controlled processes are of limited capacity, require attention, and can be used flexibly in changing circumstances.

. Automatic processes suffer no capacity limitations, do not require attention, and are very difficult to modify once they have been learned.

Schneider and Shiffrin tested these ideas in a series of experiments. They made use of a task in which subjects memorized one, two, three, or four letters (the memory set), were then shown a visual display containing one, two, three, or four letters, and finally decided as rapidly as possible whether any one of the items in the visual display was the same as any one of the items in the memory set.

In many of their experiments, the crucial manipulation was the kind of mapping used. With consistent mapping, only consonants were used as members of the memory set, and only numbers were used as distractors in the visual display (or vice versa). In other words, if a subject were given only consonants to memorize, then he or she would know that any consonant detected in the visual display must be an item from the memory set. With varied mapping, a mixture of numbers and consonants was used to form the memory set and to provide distractors in the visual display.

There were striking effects of the mapping manipulation. The numbers of items in the memory set and visual display both greatly affected decision speed in the varied mapping conditions, whereas decision speed was almost unaffected by the sizes of the memory set and visual display in the consistent mapping conditions. According to Schneider and Shiffrin (1977), a controlled search process was used with varied mapping; this involves serial comparisons between each item in the memory set and each item in the visual display until a match is achieved or until all the possible comparisons have been made.

In contrast, performance with consistent mapping reflects the use of automatic processes operating independently and in parallel. According to Schneider and Shiffrin (1977), these automatic processes evolve as a result of years of practice in distinguishing between letters and numbers. The notion that automatic processes develop through practice was tested by Shiffrin and Schneider (1977).

They used consistent mapping**READ MORE**

Attention Deficit Hyperactivity Disorder (ADHD)

Most of us take for granted our ability to pay attention and to divide our attention in adaptive ways. But not everyone can do so. People with attention deficit hyperactivity disorder (ADHD) have difficulties in focusing their attention in ways that enable them to adapt in optimal ways to their environment (Attention deficit hyperactivity disorder, 2009; see also Swanson et al., 2003).

The condition was first described by Dr. Heinrich Hoffman in 1845. Today, it has been widely investigated. No one knows for sure the cause of ADHD. It may be a partially heritable condition. There is some evidence of a link to maternal smoking and drinking of alcohol during pregnancy (Hausknecht et al., 2005; Obel et al., 2009; Rodriguez & Bohlin, 2005). Lead exposure on the part of the child may also be associated with ADHD. Brain injury is another possible cause, as are food additives—in particular, sugar and certain dyes (Cruz & Bahna, 2006; Nigg et al., 2008). There are noted differences in the frontal-subcortical cerebellar catecholaminergic circuits and in dopamine regulation in people with ADHD (Biederman & Faraone, 2005).

The three primary symptoms of ADHD are inattention, hyperactivity (i.e., levels of activity that exceed what is normally shown by children of a given age), and impulsiveness. There are three main types of ADHD, depending on which symptoms are predominant:
(a) hyperactive-impulsive, (b) inattentive, and (c) a combination of hyperactive-impulsive and inattentive behavior. We will focus on the inattentive type here because it is most relevant to the topic. Children with the inattentive type of ADHD show several distinctive symptoms:

- They are easily distracted by irrelevant sights and sounds.
- They often fail to pay attention to details.
- They are susceptible to making careless mistakes in their work.
- They often fail to read instructions completely or carefully.
- They are susceptible to forgetting or losing things they need for tasks, such as pencils or books.
- They tend to jump from one incomplete task to another

Studies have shown that children with ADHD exhibit slower and more variable reaction times than their siblings who are not affected by the disorder (Andreou, 2007). ADHD typically first displays itself during the preschool or early school years. It is estimated that about 5% of children worldwide have the disorder, though estimates range widely from less than 3% to more than 20% (Polanczyk & Jensen, 2008).

The disorder does not typically end in adulthood, although it may vary in its severity, becoming either more or less severe. There is some evidence that the incidence of ADHD has increased in recent years. During the period from 2000 to 2005, the prevalence of medicinal treatment increased by more than 11% each year (Castle et al., 2007). The reasons for this increase are not clear.

Various hypotheses have been put forward, including increased watching of fast-paced television shows, use of fast-paced video games, additives in foods, and increases in unknown toxins in the environment. ADHD is most often treated with a combination of psychotherapy and drugs. Some of the drugs currently used to treat ADHD are Ritalin (methylphenidate), Metadate (methylphenidate), and Strattera (atomoxetine). This last drug differs from other drugs used to treat ADHD in that it is not a stimulant.

Rather, it affects the neurotransmitter norepinephrine. The stimulants, in contrast, affect the neurotransmitter dopamine. Interestingly, in children, the rate of boys who are given medication for the treatment of ADHD is more than double that of girls. However, in adults, the use of ADHD medication is approximately equal for both sexes (Castle et al., 2007). A number of studies have noted that, although medication is a useful tool in the treatment of ADHD, it is

best used in combination with behavioral interventions (Corcoran & Dattalo, 2006; Rostain & Tamsay, 2006).

The theory of multiple intelligences (Gardner, 1985) has proven to be especially helpful in the treatment and support of children with ADHD. Gardner has suggested that intelligence comprises multiple independent constructs, not just a single, unitary construct. However, instead of speaking of multiple abilities that together constitute intelligence (e.g., Thurstone, 1938), this theory distinguishes eight distinct intelligences that are relatively independent of each other: linguistic, logical-mathematical, naturalist, interpersonal, intrapersonal, spatial, musical, and bodily-kinesthetic intelligence.

Each intelligence is alleged to form a separate system of functioning, although these systems can interact to produce what we see as intelligent performance. By concentrating on the students' abilities (or predominant intelligence) in educational interventions, the achievements of students with ADHD can be increased and their strengths can be emphasized (Davidson & Kemp, 2010; Schirduan & Case, 2004).

Change Blindness and Inattentional Blindness

Evolutionarily, our ability to spot predators as well as to detect food sources has been a great advantage for our survival. Adaptive behavior requires us to be attentive to changes in our environment because changes cue us to both opportunities and dangers. It thus may be surprising to discover that people can show remarkable levels of change blindness, an inability to detect changes in objects or scenes that are being viewed (Galpin et al., 2009; O'Regan, 2003). Closely related to change blindness is inattentional blindness, which is a phenomenon in which people are not able to see things that are actually there (Bressan & Pizzighello, 2008). You can find some examples for change blindness and inattentional blindness in Believe It or Not at the very beginning of Chapter 1. Change and inattentional blindness are of major importance in traffic situations or during medical screenings, for example, where an overlooked motorcycle or a mass in the body can have potentially fatal consequences.

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